DOI:
10.1111/edt.12264

Document Version
Peer reviewed version

Alcohol consumption at age 11-12 years and traumatic dental injuries at age 15-16 years in school children from East London

Muneera Baig Enver;[1] Wagner Marcenes;[2] Stephen A. Stansfeld;[3] Eduardo Bernabé[1]

[1] King's College London Dental Institute at Guy's, King's College and St Thomas Hospitals, Unit of Dental Public Health, London, United Kingdom

[2] Institute of Dentistry, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, United Kingdom

[3] Wolfson Institute of Preventive Medicine, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, United Kingdom

Running title: Alcohol use and dental trauma

Keywords: drinking behaviour, tooth injuries, adolescent, longitudinal studies

Correspondence address:

Dr. Eduardo Bernabé, Division of Population and Patient Health, King's College London Dental Institute, Denmark Hill Campus, Bessemer Road, London SE5 9RS, UK. Telephone: +44 (0) 20 3299 3022; Fax: 020 3299 3826; email: eduardo.bernabe@kcl.ac.uk

ACKNOWLEDGEMENTS

The RELACHS study was commissioned by the East London and City Health Authority to inform the Health Action Zone (http://archive.wolfson.qmul.ac.uk/relachs/academics/academic_page_index.htm). We are grateful for the support of the schools, parents and students involved in this study. We also thank the RELACHS field research team. Special thanks to Drs. Gramatti Sarri (GS) and Patricia Evans (PE), who conducted the clinical oral examinations.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest in relation to this work.

ABSTRACT

Aim: To explore the association between alcohol consumption at age 11-12 years and traumatic dental injuries (TDI) at age 15-16 years.

Methods: Data of 635 adolescents who participated in Phases I and III of the Research with East London Adolescents Community Health Survey (RELACHS), a longitudinal school-based survey of a representative sample of adolescents from East London, were used for this study. Information on socio-demographic characteristics and alcohol consumption was obtained from questionnaires in Phase I when adolescents were 11-12 years old. Data on TDI and clinical characteristics (incisor overjet and lip coverage) were taken from clinical examination in Phase III when adolescents were 15-16 years old. The association between (lifetime and last month) alcohol consumption and TDI was assessed in crude and adjusted logistic regression models.

Results: Overall, 14.5% of adolescents had ever consumed alcohol and 3.5% had consumed alcohol the month before the baseline survey whereas 17% of adolescents had experienced TDI by age 15-16 years. No significant association of alcohol consumption with TDI was seen in these adolescents for either lifetime (adjusted Odds Ratio [OR]: 0.87; 95% Confidence Interval [CI]: 0.45-1.67) or last month consumption of alcohol (adjusted OR: 0.86; 95% CI: 0.28-2.69).

Conclusion: This study did not support the association between alcohol use and TDI in adolescents.

INTRODUCTION

Traumatic dental injuries (TDI) are an important public health concern among children and adolescents due to their high prevalence, psychosocial impacts and treatment expenses (1, 2). The risk factors for TDI can be classified as intentional and non-intentional causes (3). Intentional causes involve violence and child/adult physical abuse. Non-intentional causes involve human behaviour, oral predisposing factors, sport injuries, medical illness and road traffic accidents (RTA). Human behaviour refers to an individual's behaviour and risk taking attitude which is harmful to health, such as careless drinking alcohol (3, 4).

Under the influence of alcohol the risk of an injury multiplies as it not only influences a person's psychomotor abilities involving the brain-eye-hand-foot coordination (5), but also compromises their visual focus, reaction time and judgement, resulting in RTA, sport injuries, falls, violence, etc. (6, 7). Alcohol's psychological effect involves giving individuals a false sense of control, making them aggressive and prone to danger and risk-taking behaviour, often resulting in injurious situations such as drowning, fist-fights and burns (8, 9). Adolescence is the growing age between 10-19 years of life when biological and psychological transformations occur and often children are tempted to try new experiences and be rebellious (10). The high prevalence rates of adolescents drinking alcohol, and that also at increasingly younger ages, is a growing global concern (11, 12).

Evidence on the association between alcohol consumption and TDI is still conflicting and based on cross-sectional data (13-17). A cross-sectional analysis at age 31 years of a birth cohort of 5737 adults in Northern Finland found that high consumers of alcohol were more likely to report lifetime dental fractures and traumatic tooth displacements than non-consumers. However, no adjusted estimates were reported (13). A study of 891 15-19-year-old adolescents in Belo Horizonte, Brazil, found no association between risky use of alcohol and dental injury (14). Another study among 687 15-19 year-old adolescents in Diamantina, Brazil, found that alcohol intake, hazardous alcohol use and binge drinking were associated with dental trauma at bivariate level. However, only hazardous alcohol use remained significantly associated with dental trauma after adjustment for sex, age, overjet and type of school (15). A recent study among 588 12-year-old children in Diamantina, Brazil, showed that binge drinking, but not lifetime consumption of alcoholic beverages, was associated with TDI after controlling for sex, age and lip protection (16, 17).

Alcohol consumption is a leading risk-factor for fatalities and morbidities (9, 12). Yet, its role as a risk factor for TDI is still uncertain. Longitudinal studies may shed light on this important research area. This study explored the association between alcohol consumption at age 11-12 years and TDI at age 15-16 years among school children from East London.

Materials and Methods

Study population

The Research with East London Adolescents Community Health Survey (RELACHS) is a longitudinal school-based study of a representative, ethnically diverse sample of adolescents attending 28 state secondary schools in East London, United Kingdom. RELACHS included three cross-sectional surveys of adolescents from year 7 (11-12 years) in 2001 (phase I), year 9 (13-14 years) in 2003 (phase II), and year 11 (15-16 years) in 2005 (phase III). Adolescents were selected using a stratified two-stage cluster sampling in 2001. All 42 eligible schools in the boroughs of Hackney, Tower Hamlets and Newham were initially stratified by borough and school type (comprehensive, voluntary and other). Thirty schools were selected randomly and balanced to ensure representation by single- and mixed-sex. In each of the 28 schools that agreed to participate, two representative mixed ability classes from year 7 were selected (18). A power calculation based on a previous study –where 40% of drinkers and 27% of non-drinkers had TDI, with a non-drinkers/drinkers ratio of 3.3– (17), indicated that a sample of 563 adolescents was the minimum size required to identify a significant difference in TDI between drinkers and non-drinkers, with 80% power and 95% confidence level.

Ethical approval was obtained from the East London and City Local Research Ethics Committee. Written informed consent was sought from each school's head teacher and from each adolescent. Parents were fully informed about the study and given the opportunity to opt out.

Variables selection

This study used data from RELACHS phases I and III to achieve temporal ordering between the exposure (alcohol consumption) and outcome of interest (TDI). Alcohol consumption was asssessed by self-report using standard questions drawn from the Health Survey for young people in England (19) and the Office for National Statistics (ONS) national surveys in adolescents (20, 21). Two indicators of alcohol consumption were derived from participants' responses. Lifetime alcohol consumption was defined based on responses to the question 'have you ever had a proper alcoholic

drink –a whole drink not just a sip–?' (yes/no). Last month alcohol consumption was derived from responses to the questions 'have you ever had a proper alcoholic drink –a whole drink not just a sip–?' (yes/no) and 'when was the last time you had an alcoholic drink?' (today, yesterday, some other time during last week, 1 week but less than 2 weeks ago, 2 weeks but less than 4 weeks ago, 1 month but less than 6 months ago, 6 months ago or more).

A number of demographic, socioeconomic and clinical factors (increased overjet and lip coverage) were treated as covariates. Ethnicity was self-assigned using an adaptation of the 2001 UK census categories, including 24 ethnic subcategories grouped into 5 main groups (White, Asian, Black, Mixed and Other). Socioeconomic measures included parental employment (both employed, one unemployed, both unemployed), household overcrowding (>1.5 persons/room) and family car ownership. In addition, adolescents' data for eligibility for free school meals were obtained from school records. It has been previously shown that parental employment was the most sensitive socioeconomic measure of the four assessed in this sample (22), therefore only this measure was used for the regression modelling.

Oral clinical examinations were conducted following the protocol of the World Health Organization (WHO) (23), except for the criteria to assess TDI. Two trained and calibrated examiners (GS and PE) carried out the oral clinical examinations with participants seated on an adjustable chair. Participants' teeth were not brushed or professionally cleaned prior to examination. Teeth were dried with cotton pellets and examined with plane mouth mirrors under illumination by Daray light lamps. Diagnosis was visual and no radiographs were taken. TDI were recorded according to the classification described by Glendor, Marcenes and Andreasen (24). Examiners were trained and calibrated before the main survey. At the end of this exercise, Kappa values for intra-examiner reliability were 0.87 and 0.91 and that for inter-examiner reliability was 0.80. Overjet and lip coverage were also measured during clinical examinations. Overjet was recorded as increased if it was greater than 6 mm and lip coverage was recorded as inadequate if lips were not in contact during rest position (25, 26).

Data analysis

The sociodemographic composition of the study sample (those who were followed-up) was compared with that of adolescents who were lost to follow-up, using the Chi-square test. Next, lifetime and last month alcohol consumption were compared according to participants' socio-demographic (gender,

age, ethnicity and parental employment) and clinical characteristics (lip coverage and overjet) with the Chi-squared test.

The association between lifetime alcohol consumption with TDI was assessed in crude and adjusted models using binary logistic regression as the outcome was a dichotomous variable (27). Hence, odds ratios (OR) were reported as the measure of association. The adjusted model controlled for the effect of socio-demographic and clinical characteristics. A similar modelling strategy was followed for last month alcohol consumption and TDI.

RESULTS

A total of 1382 11-12-year-olds (83% response rate) and 1030 15-16-year-olds (71% response rate) participated in RELACHS phases I and III, respectively. Of the 975 adolescents who had an oral clinical examination in Phase III, 689 had also participated in Phase I. Fifty four adolescents were excluded because of missing values in one or more covariates. Table 1 presents the characteristics of the 635 adolescents included in this study. There were significantly more females, Asians, adolescents with at least one parent employed and fewer alcohol consumers in the study sample than in the full sample of participants at phase I. Overall, 14.5% of adolescents had ever consumed alcohol and 3.5% had consumed alcohol the month before the baseline survey whereas 17% of adolescents had experienced TDI by age 15-16 years. Very few participants had increased overjet and inadequate lip coverage (9 and 3 adolescents, respectively).

There were significant differences in lifetime and last month alcohol consumption by some but not all participants' characteristics (Table 2). Lifetime alcohol consumption was significantly higher in Whites (34%) and Blacks (23%) than in Asians (1%) or adolescents of Mixed/other ethnicity (11%). It was also significantly higher in adolescents with at least one parent employed than in those with both parents unemployed (17.3% versus 8.7%). Last month alcohol consumption was also significantly higher in Whites (8%) and Blacks (6%) than in Asians and adolescents of Mixed/Other ethnicity (0.3% and 1.8% respectively). It was also significantly higher in males than females (6% versus 2%).

Table 3 shows the estimates for the association between baseline characteristics (including alcohol consumption) and TDI by age 15-16 years. Lip coverage was dropped from these analyses due to the small number of cases. The association between lifetime alcohol consumption and TDI was not significant either in the crude or adjusted model (OR: 0.87; 95% CI: 0.45-1.67). A similar result was

found for last month alcohol consumption. Both crude and adjusted models (OR: 0.86; 95% CI: 0.28-2.69) showed no significant association. Sex was the only baseline characteristic significantly related to TDI, with females having lower odds of experiencing TDI than males (Table 3).

DISCUSSION

This study provides little support for an association between alcohol consumption at age 11-12 years and TDI experience by age 15-16 years. This finding was robust to adjustments for well-known socioeconomic, demographic and clinical factors associated with TDI.

Some limitations of this study need to be borne in mind when interpreting the present results. First, there were differences in the socio-demographic composition between the study sample and the RELACHS baseline sample due to attrition. Therefore, the present findings represent valid relationships between the variables of interest but cannot be inferred to the entire study population. Second, this longitudinal study did not include an assessment of TDI at baseline, needed to estimate TDI incidence over 4 years. It is thus possible that some TDI occurred before the actual assessment of alcohol consumption. The present study addressed this issue by measuring lifetime exposure to alcohol in addition to current (last month) exposure. Even without data on TDI incidence, this study is an improvement compared to previous cross-sectional studies. Third, TDI was recorded based on visible signs of trauma (24). Although diagnostic aids (radiographs, vitality tests or trans-illumination) are useful to identify root fractures and luxation injuries (28), they are rarely available in epidemiological surveys. Furthermore, injuries to the tooth-supporting structures are not included in the classification because they do not leave any visible markers. Therefore, the prevalence of TDI in this population is probably underestimated, which in turn could have affected the ability to identify significant associations. However, the prevalence of TDI in this study was higher than the 10% found among 15-year-olds in the 2013 UK national survey (29).

A number of arguments can be put forward to explain the non-significant findings before claiming there is no true association between alcohol consumption and TDI. First, the lack association may be due to the relatively small sample size, which was not purportedly estimated to explore the relationship between alcohol consumption and TDI. However, a post-hoc power calculation confirmed that the sample size was sufficient to test the hypothesised association. It is worth noticing that the association between alcohol consumption and TDI in these adolescents was weak, suggesting that

even if significant results were obtained with larger samples, they may not be clinically meaningful compared to the effect of established risk factors for TDI. A second explanation relates to the way information on alcohol consumption was obtained from adolescents. There is a possibility of underestimation of alcohol consumption when using self-administered questionnaires, as participants may be embarrassed or fearful of admitting to their under-age drinking (30). RELACHS attempted to eliminate this problem by reminding participants that responses were strictly confidential during classroom discussions before the survey and reminders on each questionnaire page. RELACHS also combined indicators of lifetime and current alcohol consumption to reduce measurement error due to recall bias. Questionnaires are the standard method to measure alcohol consumption in epidemiological surveys (30). RELACHS questions on alcohol consumption were derived from national surveys of adolescents in England (19-21) and have been used in previous studies (31, 32). A third explanation for the lack of association between alcohol consumption and TDI could be the age at which alcohol consumption was measured. Early adolescence (11-12 years) could have been too early in life for assessing alcohol consumption since excess drinking of alcohol is mostly seen in late adolescence (33). However, the only other study among 12-year-olds found no association between lifetime alcohol consumption and TDI either (16), even though greater lifetime exposure to alcohol was found in that study compared to the present one (45.6% versus 14.5%). A final explanation relates to the measure of alcohol consumption used in this study. This study was unable to test the relationship between amount of alcohol consumed and TDI, as initially intended, due to the low number of alcohol drinkers in the sample. Previous studies among adolescents have shown significant associations with measures of excessive alcohol consumption (such as hazardous use and binge drinking) as opposed to any intake (15, 16). In addition, a greater history of TDI was reported by high consumers, but not by light consumers, when compared to non-consumers of alcohol (13). These findings suggest that the amount of consumption may be a more relevant indicator of exposure to alcohol or that there might be a threshold beyond which alcohol consumption may lead to TDI.

This is the first study on the relationship between alcohol consumption and TDI in the UK. Since as much as fifteen percent of children had tried alcohol by early adolescence, dentists should be aware of the harmful effects of alcohol drinking and be prepared to identify those with alcohol problems for referral and appropriate care. Although no significant findings were found, they provide a platform for further research looking into this association. New longitudinal studies, including both baseline and

follow-up assessments for TDI, covering other age groups during adolescence, and using alternative measures of alcohol consumption (such as amount and age at onset), are encouraged as they will provide stronger evidence on any hypothesised association.

In conclusion, this study did not support an association between alcohol consumption and TDI in adolescents from East London. Further research is required before this association can be completely ruled out and before implications for policy making are drawn.

REFERENCES

1. Glendor U. Epidemiology of traumatic dental injuries--a 12 year review of the literature. Dent Traumatol 2008;24: 603-11.

2. Aldrigui JM, Jabbar NS, Bonecker M, Braga MM, Wanderley MT. Trends and associated factors in prevalence of dental trauma in latin america and caribbean: A systematic review and meta-analysis. Community Dent Oral Epidemiol 2014;42: 30-42.

3. Glendor U. Aetiology and risk factors related to traumatic dental injuries--a review of the literature. Dent Traumatol 2009;25: 19-31.

4. Newsome PR, Tran DC, Cooke MS. The role of the mouthguard in the prevention of sports-related dental injuries: A review. Int J Paediatr Dent 2001;11: 396-404.

5. Paton A, Touquet R. *Abc of alcohol* 4th edn. Oxford: Blackwell Publishing; 2005.

6. Rehm J, Room R, Monteiro M, Gmel G, Graham K, Rehn N, et al. Alcohol as a risk factor for global burden of disease. Eur Addict Res 2003;9: 157-64.

7. Taylor B, Irving HM, Kanteres F, Room R, Borges G, Cherpitel C, et al. The more you drink, the harder you fall: A systematic review and meta-analysis of how acute alcohol consumption and injury or collision risk increase together. Drug Alcohol Depend 2010;110: 108-16.

8. Gentilello LM. Alcohol and injury: American college of surgeons committee on trauma requirements for trauma center intervention. J Trauma 2007;62: S44-5.

9. Cherpitel CJ, Borges G, Giesbrecht N, Hungerford D, Peden M, Stockwell T. *Alcohol and injuries: Emergency department studies in an international perspective*. Geneva: World Health Organization; 2009.

10. Christie D, Viner R. Adolescent development. BMJ 2005;330: 301-04.

11. Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet 2009;373: 2223-33.

12. WHO. Global status report on alcohol and health. Geneva: World Health Organization, 2014.

13. Perheentupa U, Laukkanen P, Veijola J, Joukamaa M, Jarvelin MR, Laitinen J, et al. Increased lifetime prevalence of dental trauma is associated with previous non-dental injuries, mental distress and high alcohol consumption. Dent Traumatol 2001;17: 10-6.

14. Jorge KO, Oliveira Filho PM, Ferreira EF, Oliveira AC, Vale MP, Zarzar PM. Prevalence and association of dental injuries with socioeconomic conditions and alcohol/drug use in adolescents between 15 and 19 years of age. Dent Traumatol 2012;28: 136-41.

15. Oliveira Filho PM, Jorge KO, Ferreira EF, Ramos-Jorge ML, Tataounoff J, Zarzar PM. Association between dental trauma and alcohol use among adolescents. Dent Traumatol 2013;29: 372-7.

16. de Paiva HN, Paiva PC, de Paula Silva CJ, Lamounier JA, Ferreira EFE, Ferreira RC, et al. Is there an association between traumatic dental injury and social capital, binge drinking and socioeconomic indicators among schoolchildren? PLoS One 2015;10: e0118484.

17. Paiva PC, Paiva HN, Oliveira Filho PM, Lamounier JA, Ferreira RC, Ferreira EF, et al. Prevalence of traumatic dental injuries and its association with binge drinking among 12-year-olds: A population-based study. Int J Paediatr Dent 2015;25: 239-47.

18. Stansfeld SA, Haines M, Booy R, Taylor S, Viner R, Head J, et al. *Health of young people in east london: The relachs study 2001*. London: The Stationery Office (TSO); 2003.

19. Prescott-Clarke P, Primatesta P. Health survey for england: The health of young people '95–97. London: Stationery Office, 1998.

20. Goddard E, Higgins V. Smoking, drinking and drug use among young teenagers in 1998, volumes 1 and 2. London: The Stationery Office, 1999.

21. Boreham R, Shaw A. Drug use, smoking and drinking among young people in england in 2000. London: Stationery Office, 2001.

22. Bernabé E, Stansfeld SA, Marcenes W. Roles of different sources of social support on caries experience and caries increment in adolescents of east london. Caries Res 2011;45: 400-7.

23. WHO. *Oral health surveys: Basic methods* 4th edn. Geneva: World Health Organization; 1997.

24. Glendor U, Marcenes W, Andreasen JO. Classification, etiology and epidemiology. *Textbook and colour atlas of traumatic injuries to the teeth*, 4th edition. Oxford: Blackwell; 2007.

25. Agel M, Marcenes W, Stansfeld SA, Bernabe E. School bullying and traumatic dental injuries in east london adolescents. Br Dent J 2014;217: E26.

26. Ramchandani D, Marcenes W, Stansfeld SA, Bernabe E. Problem behaviour and traumatic dental injuries in adolescents. Dent Traumatol 2015.

27. Hosmer DW, Lemeshow S, Sturdivant RX. *Applied logistic regression*. New Jersey: John Wiley & Sons; 2013.

28. Molina JR, Vann WF, Jr., McIntyre JD, Trope M, Lee JY. Root fractures in children and adolescents: Diagnostic considerations. Dent Traumatol 2008;24: 503-9.

29. Pitts N, Chadwick B, Anderson T. Children's dental health survey 2013. Report 2: Dental disease and damage in children. London: Health and Social Care Information Centre (HSCIC), 2015.

30. Del Boca FK, Darkes J. The validity of self-reports of alcohol consumption: State of the science and challenges for research. Addiction 2003;98 Suppl 2: 1-12.

31. Viner RM, Haines MM, Head JA, Bhui K, Taylor S, Stansfeld SA, et al. Variations in associations of health risk behaviors among ethnic minority early adolescents. J Adolesc Health 2006;38: 55.

32. Clark C, Haines MM, Head J, Klineberg E, Arephin M, Viner R, et al. Psychological symptoms and physical health and health behaviours in adolescents: A prospective 2-year study in east london. Addiction 2007;102: 126-35.

33. Fuller E, Hawkins V. Smoking, drinking and drug use among young people in england in 2013. London: Health and Social Care Information Centre (HSCIC), 2014.

Table 1. Characteristics of the study sample and comparison with the full sample of participants at baseline

Explanatory variables	Full sample (n=1382)		Study sample (n=635)	
	n	%	n	%
Sex				
Male	691	50.0%	293	46.1%
Female	691	50.0%	342	53.9%
Age				
11 years	441	32.1%	206	32.4%
12 years	931	67.9%	429	67.6%
Ethnicity				
White	386	28.6%	144	22.7%
Asians	542	40.1%	292	46.0%
Black	297	22.0%	143	22.5%
Mixed/Other	127	9.4%	56	8.8%
Parental employment				
Both unemployed	465	35.4%	208	32.8%
At least one employed	847	64.6%	427	67.2%
Incisor overjet				
Up to 6mm			626	98.6%
More than 6mm			9	1.4%
Lip coverage				
Adequate			632	99.5%
Inadequate			3	0.5%
Lifetime alcohol consumption				
No	1087	81.4%	543	85.5%
Yes	249	18.6%	92	14.5%
Last month alcohol consumption				
No	1255	94.2%	613	96.5%
Yes	77	5.8%	22	3.5%

Table 2. Lifetime and last month alcohol consumption by socio-demographic and clinical characteristics (n=635)

Explanatory variables	Lifetime consumption		p value[a]	Last month consumption		p value[a]
	n	%		n	%	
Sex			0.564			0.003
Male	45	15.4%		17	5.8%	
Female	47	13.7%		5	1.5%	
Age			0.493			0.146
11 years	27	23.1%		4	1.9%	
12 years	65	15.2%		18	4.2%	
Ethnicity			<0.001			<0.001
White	49	34.0%		12	8.3%	
Asians	4	1.4%		1	0.3%	
Black	33	23.1%		8	5.6%	
Mixed/Other	6	10.7%		1	1.8%	
Parental employment			0.004			0.577
Both unemployed	18	8.7%		6	2.9%	
At least one employed	74	17.3%		16	3.7%	
Incisor overjet			0.772			0.567
Up to 6mm	91	14.5%		22	3.5%	
More than 6mm	1	11.1%		0	0.0%	
Lip coverage			0.353			0.742
Adequate	91	14.4%		22	3.5%	
Inadequate	1	33.3%		0	0.0%	

[a] Chi-square was used for comparison

Table 3. Models for the association of lifetime and last month prevalence alcohol consumption with traumatic dental injuries (TDI) (n=635)

Explanatory variables	% with TDI	Model 1[a]	Model 2A[a]	Model 2B[a]
		OR[b] [95%CI]	OR[b] [95%CI]	OR[b] [95%CI]
Lifetime alcohol consumption				
No	17.7%	1.00 [Reference]	1.00 [Reference]	
Yes	16.3%	0.91 [0.50-1.65]	0.87 [0.45-1.67]	
Last month alcohol consumption				
No	17.5%	1.00 [Reference]		1.00 [Reference]
Yes	18.2%	1.05 [0.35-3.17]		0.86 [0.28-2.69]
Sex				
Male	21.8%	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Female	13.7%	0.57 [0.38-0.86]**	0.56 [0.37-0.85]**	0.56 [0.37-0.85]**
Age				
11 years	17.5%	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
12 years	17.5%	1.00 [0.65-1.55]	0.98 [0.63-1.53]	0.98 [0.63-1.53]
Ethnicity				
White	17.4%	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Asians	16.8%	0.96 [0.57-1.63]	0.85 [0.48-1.53]	0.88 [0.50-1.53]
Black	16.8%	0.96 [0.52-1.78]	0.95 [0.51-1.77]	0.96 [0.51-1.78]
Mixed/Other	23.2%	1.44 [0.68-3.06]	1.39 [0.64-3.02]	1.42 [0.66-3.05]
Parental employment				
Both unemployed	19.2%	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
At least one employed	16.6%	0.84 [0.55-1.29]	0.79 [0.51-1.23]	0.79 [0.50-1.23]
Incisor overjet				
Up to 6mm	17.6%	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
More than 6mm	11.1%	0.59 [0.07-4.74]	0.47 [0.06-3.94]	0.47 [0.06-3.94]

[a] Model 1 was unadjusted; Model 2A was adjusted for lifetime alcohol consumption, sex, age, ethnicity, parental employment and incisor overjet; and Model 2B was adjusted for last month alcohol consumption, sex, age, ethnicity, parental employment and incisor overjet.
[b] Logistic regression was used for testing associations and odds ratios (OR) reported.
* p< 0.05; ** p<0.01; *** p<0.001